(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
4 January 2001 (04.01.2001)

PCT

(10) International Publication Number
WO 01/01331 A1

(51) International Patent Classification[7]: G06K 9/00

(21) International Application Number: PCT/US00/17157

(22) International Filing Date: 21 June 2000 (21.06.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/141,538 28 June 1999 (28.06.1999) US
60/141,763 30 June 1999 (30.06.1999) US

(71) Applicant *(for all designated States except US)*: **DIGIMARC CORPORATION** [US/US]; Suite 250, 19801 SW 72nd Avenue, Tualatin, OR 97062 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **DAVIS, Bruce, L.** [US/US]; 15599 Village Drive, Lake Oswego, OR 97034 (US). **RHOADS, Geoffrey, B.** [US/US]; 304 S.W. Tualatin Loop, West Linn, OR 97068 (US).

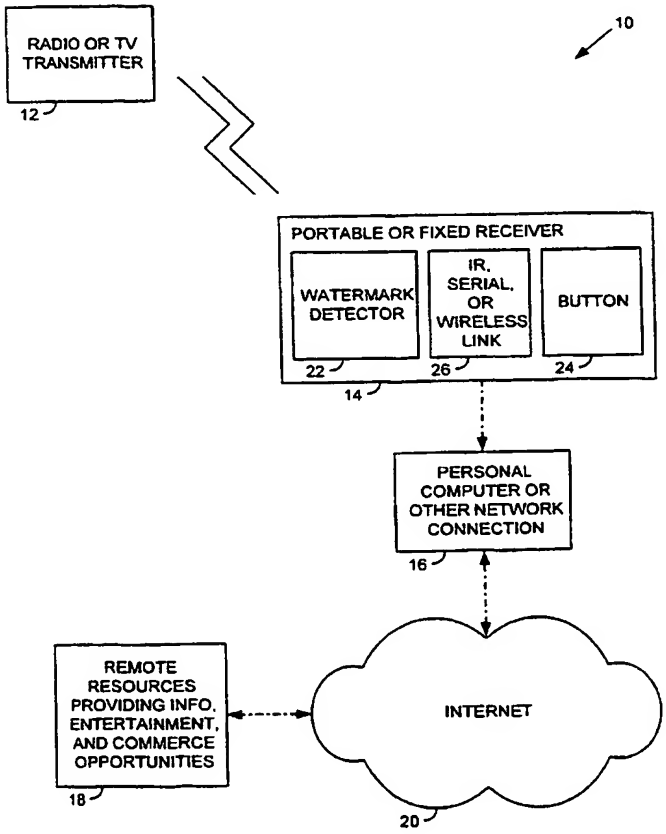
(74) Agent: **CONWELL, William, Y.**; Digimarc Corporation, Suite 250, 19801 SW 72nd Avenue, Tualatin, OR 97062 (US).

(81) Designated States *(national)*: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European

[Continued on next page]

(54) Title: DIGITAL WATERMARKS IN TV AND RADIO BROADCASTS



(57) Abstract: Wireless (26) and Internet (20) broadcasts can carry in-band digital information through the use of watermark technology (22). This digital information can be used to direct a user to a particular Internet site or resident application for supplemental or complimentary information, entertainment, merchandising, and commerce opportunities (18).

WO 01/01331 A1

patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Published:

— *With international search report.*

DIGITAL WATERMARKS IN TV AND RADIO BROADCASTS

Related Application Data

This application claims priority to provisional applications 60/141,763, filed June 30, 1999; and 60/141,468, filed June 29, 1999.

The subject matter of the present application is related to that disclosed in US Patent 5,862,260, and in copending applications 08/746,613, filed November 12, 1996 (allowed, also published as WO 9743736); 09/343,104, filed June 29, 1999; 60/164,619, filed November 10, 1999; 09/503,881, filed February 14, 2000; 09/525,865, filed March 15, 2000; and 09/547,664, filed April 12, 2000.

Background and Summary of the Invention

Broadcast signals can carry in-band digital information though use of known watermark technology (a few examples of which are detailed in the cited patents and applications). This digital information can be used to direct a user to a particular internet site or resident application for supplemental or complimentary information, entertainment, merchandising, and commerce opportunities.

Brief Description of the Drawings

Fig. 1 shows an illustrative embodiment of the present invention.

Detailed Description

Referring to Fig. 1, an illustrative embodiment 10 of the present invention includes a radio or television transmitter 12, a portable or fixed radio or television receiver 14, a personal computer or other network connection 16, and remote resources 18 available through the internet 20.

The transmitter 12 is conventional, but includes a watermark encoder to embed a digital watermark in the transmitted signal. The receiver 14 is likewise generally conventional (e.g., including an RF amplifier, a mixer, one or more

intermediate frequency amplifiers, and a detector), but additionally includes a watermark detector 22, a button or other user interface feature 24 (which may be on a remote control associated with the receiver), and an external interface 26 (e.g., infrared, wireless, Bluetooth, serial, USB, firewire, etc.). In some embodiments, the receiver can be a species of computer.

The watermark encoding and decoding can follow the techniques set forth in the cited patents and applications. In such arrangements, the watermark payload data is combined with a pseudo-random carrier signal (e.g., by multiplying, XORing, etc.), and combined with (e.g. added to) the audio or video content signal. The carrier signal may be shaped in various ways. For example, zeroes in the carrier signal can be omitted (e.g., leaving values of –1 and 1, or –2, -1, 1, and 2, etc.), or the frequency spectrum of the carrier can be tailored to match the frequency spectrum of the signal being encoded, etc. In some embodiments, the watermarking also encodes a calibration signal with the payload data. This calibration signal is used in decoding, as detailed in the cited patents and applications (e.g., to permit accurate detection of the payload data even from a corrupted signal).

The computer 16 can be a personal computer, an internet appliance, or other network interface device. The computer includes provision for communicating with the external link of the receiver 14, and also includes a network connection for coupling to the internet 20. The remote resources 18 include the myriad servers coupled to the internet to provide information, entertainment, and commerce opportunities to users thereof.

In the illustrated system, audio material (such as a song or an advertisement) is transmitted to the receiver in the usual manner. Encoded in the audio signal is digital information represented as a watermark. Upon decoding at the receiver, this information is transmitted to the computer 16 (or stored for later transmission if the receiver does not have a persistent network connection).

The encoded information need only comprise a unique identifier, or database key. When passed to the computer 16 (and optionally therefrom to a remote resource 18), the identifier serves to initiate from such device one or more supplemental or complimentary applications corresponding to the encoded broadcast content, such as

purchasing a song for download, purchasing a CD containing the song, viewing news and concert schedules for recording artists, viewing a music video, etc.

Similar arrangements and benefits can be delivered through watermarked spoken word programming, and through television (video) broadcasts. The broadcasts can be distributed through any of the conventional methods other than over-the-air, including cable and satellite.

The infrastructure through which the receiver 16 couples to the remote resources 18 can take various forms. In application 09/547,664, filed April 12, 2000, the assignee detailed one such arrangement. In that system, the user device (e.g., receiver 14 or computer 16) dispatches the watermark ID to a router computer. That computer includes a database that stores a URL corresponding to each watermark ID. Upon receiving a watermark ID, the router computer returns the corresponding URL to the originating device (12 or 16). A browser at the originating device then establishes a link to the specified URL. That URL then provides the information, entertainment, or commerce opportunity corresponding to the encoded broadcast.

The just-detailed system is advantageous in that it permits the encoding of a short identifier in the broadcast (e.g., instead of a lengthy URL). Moreover, the corresponding URL can be changed over time, as needed. Other embodiments of the present invention, however, do not need this level of complexity; the encoded identifier can more directly trigger the desired remote resource response.

Turning to particular cases, consider a product advertisement encoded with watermark data that links to product specifications, multi-media product demonstrations, and/or purchase instructions. Alternatively, for commonplace items, the user might merely push a "buy" button 24 on the receiver and the order could be placed automatically (e.g., using one-click technology of the type detailed in Amazon's patent 5,960,411), or an order form could be invoked on the screen of the computer 16 as soon as the data was transmitted to it.

If a particular song was playing, the digital watermark transmitted with the song could cause a picture of the singer to appear on the personal computer. Alternatively, through an automatic link to the internet, users could indicate their like or dislike for the song. In still other applications the link can be used to allow the user

to indicate a "vote" concerning a subject being played over the audio link. (In such embodiments, the embedded ID identifies the subject matter being voted on, and likewise serves to specify the remote resource 18 that is to receive the vote. To that resource the user's computer can dispatch a "yes" or "no" vote, a "like" or "dislike" preference, etc., by corresponding data sent over the internet.

As will be recognized, embodiments like that detailed can be used to enable interactive advertisement and promotion for local radio and TV broadcasters, generating traffic and fulfillment activities for local merchants. In one such embodiment, network broadcast content is locally customized with links corresponding to local merchants and other resources. Thus, a Ford advertisement may be customized to initiate a link to a local Ford dealership.

(Such local customization can be performed by the broadcaster or by another party. In some embodiments, nationally-distributed broadcast content can include links suitable for a national audience (e.g., to corporate web sites of advertisers). The local broadcaster may process such network feeds to identify such national links. When same are encountered, the local broadcast processor may look-up a corresponding local link. The existing national link data can then be replaced with the local link data. Or, the broadcast may have been encoded with "blank" watermark payload bits that can be filled-in by the local broadcaster without removing the national link. These supplemental payload bits can serve to indicate the locality in which the payload was received, permitting a router computer or the like to return a URL appropriate to that area.)

By employing such watermark-based content augmentation, satellite content distribution can enjoy a virtual high speed asynchronous network capability by downstreaming relatively small digital watermark payloads as segues to PCs and other devices with higher bandwidth connections. Rather than sending large payloads via the satellite link, the distributor sends "pointers" that direct receivers and recipients to certain applications on the other networks; essentially, off-loading the heavy lifting to other carriers so as to provide more value to its customers and content providers with very little bandwidth consumption. Auxiliary content that is not desired by all satellite subscribers is not sent over the satellite; those subscribers

employ the satellite-conveyed watermark data to obtain such auxiliary content using other connections (e.g., terrestrial internet).

Radio over the internet is increasingly popular. However, the screen of the internet terminal is poorly utilized in such radio broadcasts. In accordance with another aspect of the invention, a watermark decoded from a web broadcast is decoded, and is used to enhance the experience by supplementing the audio with accompanying visual presentations.

In one such embodiment, the display presents streaming and other media on the screen while the internet radio is playing, such ancillary content being related to the then-broadcast radio content. This ancillary visual information can include concert schedules, fan news about the musician or person being broadcast, commercial web sites offering CDs, etc. During radio advertisements the display can present associated commercial information, with accompanying visual and/or video promotional materials. In addition to eye-catching visual presentations, these displays can include the opportunity to buy the advertised product, or download a "trial" version. (The visual displays can include conventional user interface features, such as buttons that can be selected by a user to initiate a purchase transaction or other operation in known manners.)

Technically, the computer radio decodes embedded watermark data from the audio programming. In some embodiments, the watermark literally conveys the address of one or more web sites that are to be displayed. The computer can be programmed to recognize these embedded web addresses, and display the corresponding web content in one or more separate browser windows. These windows can be tiled or otherwise presented on the display screen, together with the radio user interface. (The ancillary windows may overlie the radio interface in some embodiments.) As the radio content changes, the embedded watermark information also changes. Web displays corresponding to the earlier-decoded watermark are discontinued, and new web displays corresponding to the current watermark information are presented.

As noted, the audio broadcast need not be literally encoded with web addresses. Instead, the audio can be encoded with data including an identifier (e.g., 32

bits). On detecting this identifier, the computer connects to a remote web server (whose address is pre-identified) and provides this identifier. The remote server responds with the web addresses of the content to be displayed. The local computer then loads and displays these web pages, as in the first embodiment. As the audio programming changes, the embedded identifier also changes, leading to changed web addresses corresponding to the current audio material.

Returning to the original example of a watermark-aware radio, consider a car radio that has a "capture" button on the front panel (or other form of user interface, e.g., a Capture icon on a GUI). If a user hears a song they want to record and keep, they press the Capture button while the song is playing. In response, the radio device decodes a watermark embedded in the music, and thereby knows the identity of the music. The radio then makes a wireless transmission identifying the user and the desired song. A local repeater network picks up the wireless signal and relays it (e.g. by wireless rebroadcast, by modem, or other communication medium) to a music clearinghouse. The clearinghouse charges the user a nominal fee (e.g. via a pre-arranged credit card), and queues the music for download to a predetermined location associated with the user.

In one embodiment, the predetermined location is the user's own computer. If a "live" IP address is known for the user's computer, the music can be transferred immediately. If the user's computer is only occasionally connected to the internet, the music can be stored at a web site (e.g. protected with a user-set password), and can be downloaded to the user's computer whenever it is convenient.

In other embodiments, the predetermined location is a personal music library maintained by the user. The library can take the form, e.g., of a hard-disk or semiconductor memory array in which the user customarily stores music. This storage device is adapted to provide music data to one or more playback units employed by the user (e.g. a personal MP3 player, a home stereo system, a car stereo system, etc.). In most installations, the library is physically located at the user's residence, but could be remotely sited, e.g. consolidated with the music libraries of many other users at a central location.

The personal music library can have its own internet connection. Or it can be equipped with wireless capabilities, permitting it to receive digital music from wireless broadcasts (e.g. from the clearinghouse). In either case, the library can provide music to the user's playback devices by short-range wireless broadcast.

By such arrangement, a user can conveniently compile an archive of favorite music – even while away from home.

Many variants of the foregoing are of course possible. The radio can be a portable unit (e.g. a boombox, a Walkman radio, etc.) or a home device, rather than an automotive unit. The UI feature employed by the user to initiate capture a musical selection need not be a button (physical or on-screen). For example, in some embodiments it can be a voice-recognition system that responds to spoken commands, such as "capture" or "record." Or it can be a form of gesture interface.

Instead of decoding the watermark only in response to the user's "capture" command, the radio can decode watermarks from all received programs, and keep the most recent in a small FIFO memory. By such arrangement, the user need not issue the capture instruction while the song is playing, but can do so even after the song is finished.

In some embodiments, data corresponding to the watermark can be made available to the user in various forms. For example, it can be presented to the user on an LCD screen, identifying the artist and song currently playing. If a corresponding UI button is activated, the device can so-identify the last several selections. Moreover, the data need not be presented to the user in displayed form; it can be annunciated by known computer-speech technologies instead.

In embodiments in which the watermark does not convey ASCII text data, but instead conveys UIDs (unique identifiers), or coded abbreviations, the device must generally interpret this data before presenting it to the user. In an illustrative embodiment, the device is a pocket-sized FM radio and is equipped with a 1 megabyte semiconductor non-volative RAM memory. The memory includes a data structure that serves as a look-up table, matching code numbers to artist names and song titles. When the user queries the device to learn the identify of a song, the memory is indexed in accordance with one or more fields from the decoded

watermark, and the resulting textual data from the memory (e.g. song title and artist) is annunciated or displayed to the user.

In most applications, such memory will require frequent updating. The RF receiver provides a ready mechanism for providing such updated data. In one embodiment, the radio "awakens" briefly at otherwise idle moments and tunes to a predetermined frequency at which updated data for the memory is broadcast, either in a baseband broadcast channel, or in an ancillary (e.g. SCA) channel. Or such data can be repeatedly transmitted on an SCA channel, received whenever the radio is turned on.

In variants of the foregoing, internet delivery of updated memory data can be substituted for wireless delivery. For example, the artist/song title memory in the personal player can be updated by placing the player in a "nest" every evening. The nest (which may be integrated with a battery charger for the appliance) can have an internet connection, and can exchange data with the personal device by infrared, inductive, or other proximity-coupling technologies, or through metal contacts. Each evening, the nest can receive an updated collection of artists/song titles, and can re-write the memory in the personal device accordingly. By such arrangement, the watermark data can always be properly intepreted for presentation to the user.

The "Capture" concepts noted above can be extended to other functions as well. One is akin to forwarding of email. If a consumer hears a song that another friend would enjoy, the listener can send a copy of the song to the friend. This instruction can be issued by pressing a "Send" button, or by invoking a similar function on a graphical (or voice- or gesture-responsive) user interface. In response, the appliance so-instructed can query the person as to the recipient. The person can designate the desired recipient(s) by typing in a name, or a portion thereof sufficient to uniquely identify the recipient. Or more typically, the person can speak the recipient's name. As is conventional with hands-free vehicle cell phones, a voice recognition unit can listen to the spoken instructions and identify the desired recipient. An "address book"-like feature has the requisite information for the recipient (e.g., the web site, IP address, or other data identifying the location to which music for that recipient should stored or queued, the format in which the music should be delivered,

etc.) stored therein. In response to such command, the appliance dispatches instructions to the clearinghouse, including an authorization to debit the sender's credit card for the music charge. Again, the clearinghouse attends to delivery of the music in a desired manner to the specified recipient.

Still further, a listener may query the appliance (by voice, GUI or physical button, textual, gesture, or other input) to identify CDs on which the then-playing selection is recorded. Or the listener may query the appliance for the then-playing artist's concert schedule. Again, the appliance can contact a remote database, relay the query, and forward data from the watermark payload identifying the artist and/or song title to which the query relates. The database locates the requested data, and relays same back to the appliance for presentation (via a display, by machine speech, or other output) to the user. If desired, the user can continue the dialog with a further instruction, e.g., to buy one of the CDs on which the then-playing song is included. Again, this instruction may be entered by voice, GUI, etc., and dispatched from the appliance to the clearinghouse, which can then complete the transaction in accordance with pre-stored information (e.g. credit card account number, mailing address, etc.). A confirming message is relayed to the appliance for presentation to the user.

While the foregoing transactions require a link to a remote site or database, other watermark-based consumer services can be provided without such a link. For example, a user can query the appliance as to the artist or song-title of the selection currently playing. The appliance can consult the embedded watermark data (and optionally consult a memory to determine the textual names associated with coded watermark data), and provide the requested information to the user (e.g., by a display, annunciation, or other output).

The foregoing concepts (e.g. Capture, Send, etc.) can also be employed in connection with internet- rather than radio-delivery of music.

In other embodiments of the invention, the broadcast is not encoded with different data at different times (e.g., a different payload for each song). Instead, the broadcast is constantly encoded with a single identifier, e.g., identifying the broadcaster. The encoding can be the broadcaster's FCC call sign, a binary identifier corresponding to a particular station, etc. Such encoding can be effected anywhere in

the audio chain, e.g., in the audio feed between the studio and the broadcast transmitter. The audio signal can be converted to digital form (if not already in such form), summed with a low level watermark signal, and converted back to analog form (if necessary).

In such arrangements, the user device (e.g., receiver 14) can include a real time clock. When a user hears or sees a broadcast of interest, and operates the "Capture" button (or other user interface feature), time data from the clock is written into a memory. The time data, and the decoded station identifier, can then (or later) be forwarded to a remote database to which the broadcaster writes its play log. By indexing the broadcaster's play log with the captured time data, the audio (or video) selection being broadcast at that instant can be identified. The content identifier thereby obtained can then be utilized as above-described to augment the user's enjoyment of the broadcast.

From the foregoing, it will be recognized that certain embodiments of the present invention allow internet and broadcast audio/video to be used to invoke the presentation of ancillary promotions, merchandizing, supplemental information, and entertainment – all keyed off watermark data.

To provide a comprehensive disclosure without unduly lengthening this specification, the above-detailed patents and applications are incorporated herein by reference.

Having described and illustrated the principles of the invention with reference to illustrative embodiments, it should be recognized that the invention is not so limited.

For example, while the detailed embodiment included a watermark decoder as part of the broadcast receiver, this is not essential. In other embodiments the receiver may include, for example, a memory (e.g., RAM) in which sampled excerpts of received audio can be stored under control of an associated CPU. The stored audio can thereafter be transferred to the computer 16, and the watermark decoded therefrom at the computer.

To save storage space in the receiver memory, the audio can be processed to reduce its size, without unduly impairing the watermark information conveyed

thereby. One way this can be accomplished is to high pass filter the audio (e.g., with a cutoff frequency of one-fourth the sample frequency). Then the filtered audio can be quantized into a three state signal: -1, 0, or 1, depending on the polarity of the filtered signal. (Values within a predetermined threshold of 0 can be assigned a value of 0.) It will be recognized that such processing is a form of lossless compression – lossy because the process is not reversible. The watermark payload can be decoded from the resulting three-state signal (e.g., using the techniques disclosed in the cited patents and applications), even though the underlying audio carrier signal is essentially lost. This bit sequence can be further compressed using known lossless compression techniques (e.g., LZ77 or LZ78) to further save on storage requirements.

The just-described processing technique is illustrative only. The high pass filtering can be used without the quantization, and vice versa. Still other compression techniques can naturally be used, provided same do not unduly impair the encoded watermark information.

In one particular embodiment in which the receiver logs snippets of audio, all audio received by the receiver is digitized, and the last 5 seconds are always available in a FIFO RAM buffer. Upon activating the button 24 or other control, those 5 seconds of audio are copied into a separate retention memory, and the five next-following seconds of audio are likewise written into that retention memory, yielding 10 seconds of data from which the watermark can later be discerned. (The audio processing operation just described can be performed on-the-fly during such operation, or by post processing.) A number of such excerpts can be stored – one each time the button 24 is activated - depending on the capacity of the retention memory. Known user interface techniques can be employed to allow the user to manage this collection of data excerpts, e.g., controlling which are transmitted to the computer 16, which are invoked to obtain related internet content, which are permanently stored on-disk in the computer 16 to serve as long-term bookmarks to internet sites of particular interest, etc.

While receiver 14 and computer 16 are described as separate units, this need not be the case. The detailed functionality of these devices can be provided in a single unit.

Similarly, while the detailed embodiments employ particular watermarking techniques detailed in the cited patents and applications, the principles are equally applicable with any other digital watermarking technology, including those that transform the audio or video signal to another domain (e.g., wavelet, DCT, etc.), and alter the signal representation by changing the signal coefficients in such domain.

More generally, while the detailed embodiments have employed watermark technology, other arrangements can employ different auxiliary data-conveyal technologies, including SCA subcarriers, vertical blanking interval techniques, etc.

While the detailed embodiments focused on audio broadcast applications, the same principles can be employed with television, e.g., by encoding the picture information or the accompanying sound information. And, as noted, the techniques are likewise applicable to the internet-delivery of content, not involving over-the-air broadcast.

While the detailed embodiments contemplated that the broadcast content would correspond to a single internet destination, in other embodiments this may not be the case. In some embodiments, a song or other content may correspond to links to several alternative destinations. The user can be presented a menu of such links from which to choose. Or a link to one of several alternative destinations may be automatically chosen based on the context or environment in which the content was encountered. (E.g., if a user activates the "Capture" button on a portable radio receiver, a different link may be pursued than if the user actives the button while using a desktop computer. In such cases, context information sufficient to distinguish such settings would be relayed from the device to the remote system.)

In some of the above-described embodiments, the augmentation of the broadcast content is initiated by a user action, e.g., activating a Capture button. In others, the augmentation is automatic (e.g., presentation of streaming media corresponding to a watermark decoded from received audio). Still other arrangements are possible. For example, the augmented information can be automatically retrieved, but not presented to the user unless called for. The augmentation data can be cached, e.g., on the user's device, and presented immediately, on demand. In one such arrangement, a user listening to an internet radio broadcast can summon additional

information by using dropdown menus of the sort typically associated with Windows applications. A "More" menu could present options such as "About the artist," "Order this music," "Concert schedules," etc. Unless requested, such information stays hidden. But when such menu is activated, the corresponding information is delivered from the cache.

The particular combinations of elements and features in the above-detailed embodiments are exemplary only; the interchanging and substitution of these teachings with other teachings in this and the incorporated-by-reference patents/applications are also contemplated.

In view of the wide variety of embodiments to which the principles and features discussed above can be applied, it should be apparent that the detailed embodiments are illustrative only and should not be taken as limiting the scope of the invention. Rather, we claim as our invention all such modifications as may come within the scope and spirit of the following claims and equivalents thereof.

WE CLAIM:

1. In a radio or television broadcasting system that conveys a content signal to an audience, an improvement comprising steganographically encoding the content signal with an in-band digital watermark prior to its broadcast, the digital watermark conveying a plural-bit identifier, the identifier serving to identify an internet-available resource to which a recipient of said content signal can refer to obtain additional information or commerce opportunities related to the broadcast.

2. The method of claim 1 in which the identifier does not convey a literal URL, but instead conveys a code that is mapped to a corresponding URL through a database.

3. The method of claim 1 in which said encoding includes processing with a shaped pseudo-random signal.

4. A broadcasting system that broadcasts beyond a single local area, according to claim 1, in which each of several local broadcast outlets to which the content is distributed encode the content with a different digital watermark, so that the internet-available resources identified thereby are customized to the outlets' respective localities.

5. The broadcasting system of claim 3 in which the local outlet encoding of said content with said watermark is performed in response to detection of a different watermark in an input content signal.

6. A broadcast receiver, the receiver having an RF amplifier, a mixer, an intermediate frequency amplifier, a detector, a speaker, and a watermark decoder, the watermark decoder serving to decode a plural-bit digital watermark steganographically encoded within a received broadcast signal, said plural-bit digital watermark serving to identify an internet-available resource to which a user of said

receiver can refer to obtain additional information or commerce opportunities related to the broadcast.

7. The receiver of claim 6 in which the watermark decoder employs a shaped pseudo-random signal to decode said watermark.

8. The receiver of claim 6 in which the watermark decoder refers to a calibration signal embedded as part of the digital watermark in decoding said watermark.

9. The receiver of claim 6 in which the watermark decoder has an input coupled to an output of the detector.

10. The receiver of claim 6 in which the watermark decoder has said input coupled to the speaker.

11. A television receiver according to claim 6.

12. A radio receiver according to claim 6.

13. The receiver of claim 6 further including a control by which a user can cause the receiver to act upon a watermark in said received broadcast signal.

14. The receiver of claim 6 further comprising a memory, the receiver serving to store decoded watermark data in said memory.

15. The receiver of claim 14 further including a control by which a user can cause the receiver to store the decoded watermark data in said memory.

16. The receiver of claim 6, further including an interface permitting coupling of data from said receiver to a remote device.

17. The receiver of claim 16 in which the interface includes a wireless transmitter.

18. The receiver of claim 17 in which the wireless transmitter comprises an infrared transmitter.

19. The receiver of claim 16 in which the interface couples to a computer device.

20. The receiver of claim 6, further comprising a memory, the memory having data stored therein permitting decoded watermark data to be interpreted into human-understandable form.

21. The receiver of claim 20, further including a display on which data from said memory can be presented to a user.

22. The receiver of claim 20, further including an annunciator for announcing data from said memory to a user.

23. A method of operating a receiver comprising:

listening to or viewing an output from said receiver until content of interest is presented;

activating a control associated with said receiver, said activation initiating the following events:

transmitting data corresponding to an in-band watermark detected in said content, from said receiver to an internet connected resource; and

receiving information or a commerce opportunity relating to said content of interest from the internet

24. The method of claim 23 in which the events initiated by activation of said control including decoding a watermark from said content of interest.

25. The method of claim 24 in which said decoding includes processing with a shaped pseudo-random signal.

26. The method of claim 24 in which the decoding includes detecting a calibration signal encoded as part of said watermark.

27. The method of claim 23 in which the events initiated by activation of said control include reading earlier-decoded watermark data from a memory in said receiver for transmission to the internet connected resource.

28. The method of claim 23 that includes:

receiving the transmitted data at a first internet-connected resource;

identifying at said first resource a URL identifying a second internet-connected resource that corresponds to said transmitted data; and

providing data from said URL to a user of the receiver.

29. The method of claim 28 that includes relaying said URL from the first internet-connected resource to a computer associated with the user, and directing a browser on said computer to said URL.

30. A broadcast receiver, the receiver having an RF amplifier, a mixer, an intermediate frequency amplifier, a detector, a speaker, a sampler, a processor, and a memory, the processor serving to selectively store data corresponding to a received broadcast to the memory, said data encoding a plural-bit digital watermark that identifies an internet-available resource to which a user of said receiver can refer to obtain additional information or commerce opportunities related to the broadcast.

31. The receiver of claim 30 in which the processor stores said sampled data in response to user activation of a control.

32. The receiver of claim 30 in which the data stored in the memory is not simply sampled broadcast data, but has been processed by the processor to reduce storage space while still permitting the watermark to be decoded therefrom.

33. A signal processor assembly comprising:

an input for receiving a sampled content signal having a plural-bit digital watermark steganographically encoded therein; and

a processor for processing the sampled content signal to remove low frequency components thereof, the processed signal nonetheless including said watermark therein.

34. The signal processor of claim 33 in which the processor performs a high pass filtering operation on the sampled content signal.

35. The signal processor of claim 33 in which the processor performs a three-state quantization operation on the sampled content signal.

36. A broadcast receiver according to claim 33, additionally including an RF amplifier, a mixer, an intermediate frequency amplifier, a detector, a speaker, and a sampler.

37. A method of signal processing, comprising:

receiving a sampled content signal having a plural-bit digital watermark steganographically encoded therein;

high pass filtering the sampled content signal to remove low frequency components thereof; and

storing the filtered signal in a memory; and

thereafter, providing the stored, filtered signal to a watermark decoder.

38. A computer device including a memory, an internet interface, and a watermark decoder, characterized in that the memory has a processed content signal stored therein that encodes a plural-bit digital watermark, the content signal corresponding to audio, video, or still image content, but being sufficiently processed that the signal is substantially unusable to render audio, video, or still image content to a user of the device, the watermark identifying an internet-available resource to which a user of said device can refer through said interface to obtain additional information or commerce opportunities related to the content.

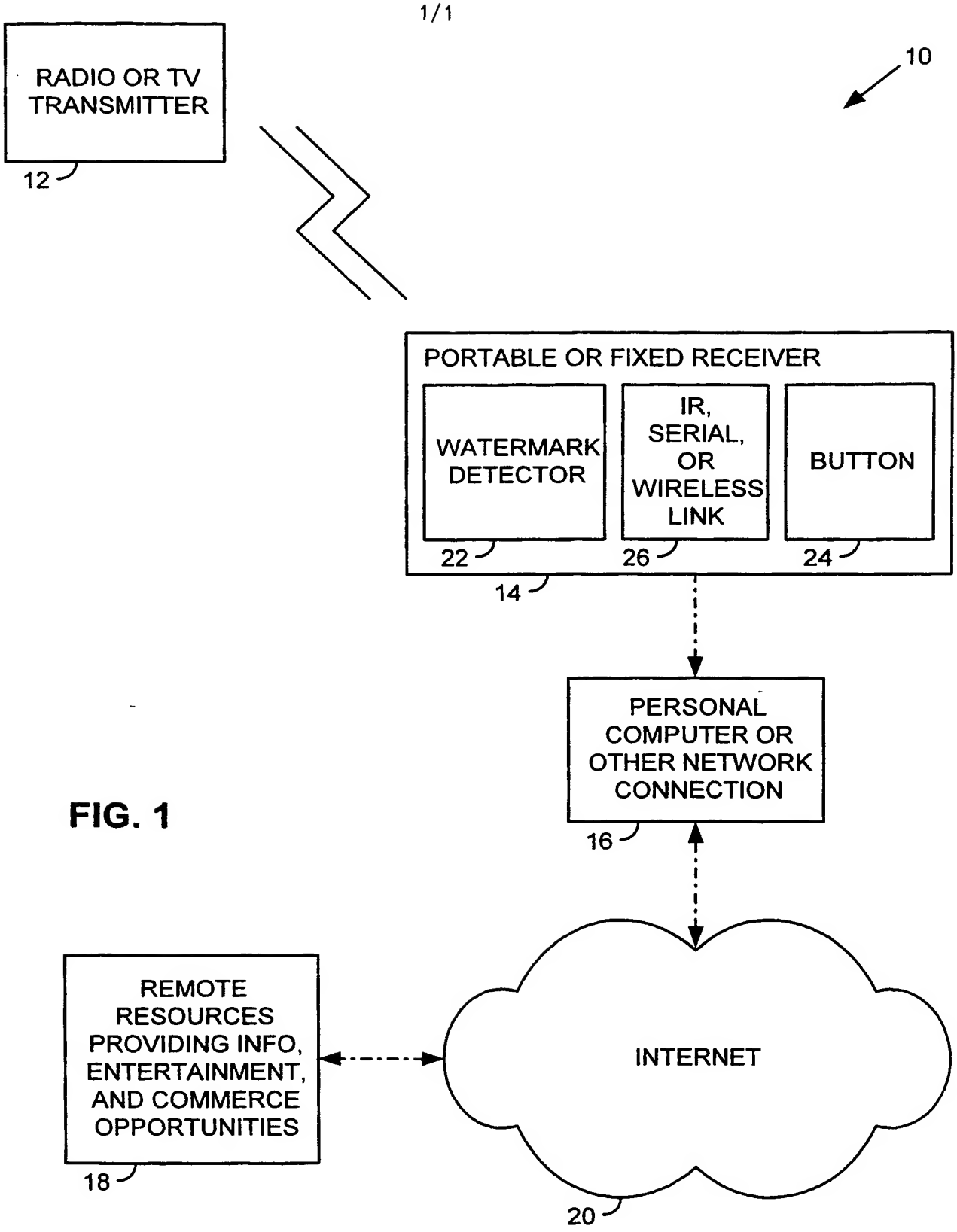

RADIO OR TV TRANSMITTER
12
10
PORTABLE OR FIXED RECEIVER
WATERMARK DETECTOR
22
IR, SERIAL, OR WIRELESS LINK
26
BUTTON
24
14
PERSONAL COMPUTER OR OTHER NETWORK CONNECTION
16
REMOTE RESOURCES PROVIDING INFO, ENTERTAINMENT, AND COMMERCE OPPORTUNITIES
18
INTERNET
20

FIG. 1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/17157

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) : G06K 9/00
US CL : 382/100, 232; 380/54
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 382/100, 232; 380/54

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EAST 1.1, IEEE
Search terms: watermark, broadcast, video, audio, internet, amplifier, receiver

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,892,900 A (GINTER et al.) 06 April 1999, fig. 1, elements 200, 204, 205, 208; col. 5, lines 15-45; col. 37, lines 15-50.	1-38
Y	US 5,778,102 A (SANDFORD, II et al.) 07 July 1998, fig.11, elements 11, 12; col. 13, lines 29-45; col. 15, lines 9-34.	1-38
Y	US 5,900,608 A (IIDA) 04 May 1999, fig. 1, elements 10, 20; fig. 14, element 300, 400; col. 25, lines 10-40.	1-38
Y	US 5,915,027 A (COX et al.) 22 June 1999, col. 4, lines 15-40.	1-38
A	US 5,673,316 A (AUERBACH et al.) 30 September 1997, col. 6, lines 15-47	1-38

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 21 SEPTEMBER 2000	Date of mailing of the international search report 18 OCT 2000
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer JAY PATEL James R. Matthews Telephone No. (703) 308-7728

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/17157

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,742,845 A (WAGNER) 21 April 1998, fig. 1, element 14; col. 7, lines 25-55.	1-38